NEW TECHNOLOGY EMC MEASUREMENT ON ADVANCE VEHICLE

RSTW
AE Edmund

ROHDE&SCHWARZ
Make ideas real

AGENDA

- CISPR25 & CISPR36 Standard:
  - Standard Updated Overview
  - HV Component and Module Measurement
- ISO11452-4 (2020) Standard: Bulk Current Inject Measurement:
  - Standard Updated Overview
  - Bulk Current Inject Measurement
- EMC Test Solution Overview
- Q&A

CISPR STANDARD OVERVIEW

- **CISPR – Purpose and publication levels**
- **CISPR 16 – Normative references**
- **CISPR product standards for emission measurements**
  - **CISPR 11 – Industrial, scientific and medical equipment**
  - **CISPR 12 – Automotive, protection of off-board receivers**
  - **CISPR 14-1 – Household appliances and electric tools**
  - **CISPR 15 – Lighting equipment**
  - **CISPR 25 – Automotive, protection of on-board receivers**
  - **CISPR 32 – Multimedia equipment**
  - **CISPR 36 – Automotive, Radiated emission below 30 MHz**

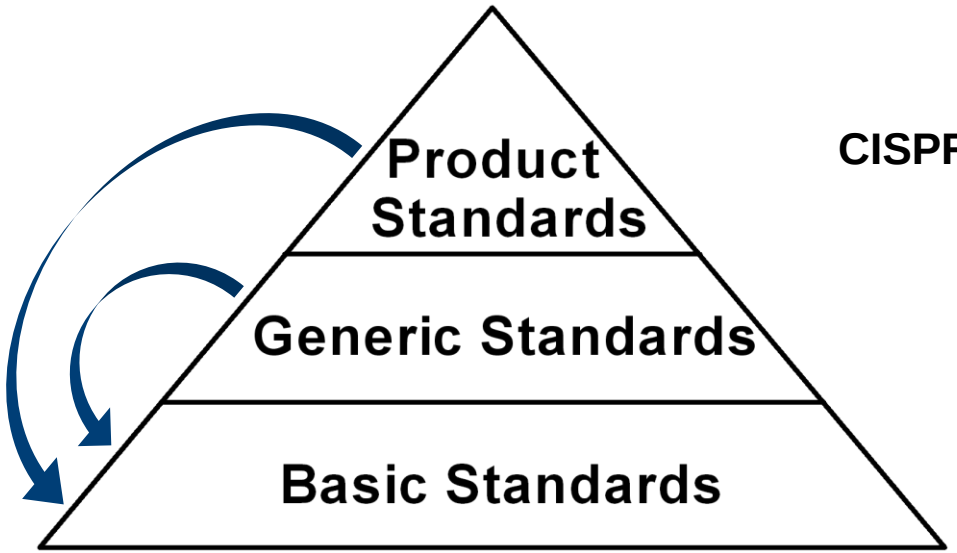
CISPR | International special committee on radio interference | Comité international spécial des perturbations radioélectriques

- Technical committee within the International Electrotechnical Commission (IEC)
- The committee is constituted of 7 sub-committees that fulfil both product (vertical) and basic (horizontal) standardisation roles
- CISPR was established in 1933 and had its first meeting in June 1934 in Paris, with representatives of 6 national committees of the IEC (Belgium, The Netherlands, Luxembourg, France, Germany and UK)
- Today CISPR one of 115 technical committees of IEC
- Members of CISPR are 41 National Committees (24 participate / 17 observer), EBU, ETSI, CIGRE, IARU and both ITU-R and ITU-T

WAS ESTABLISHED TO CONSIDER THE PROTECTION OF RADIO RECEPTION FROM INTERFERENCE

CISPR STANDARD OVERVIEW

- CISPR publications are structured into 3 levels
- Basic standards come into force with normative references in generic and product standards, today all standards have dated references, specific edition applies!



CISPR 11, 12, 14-1, 15, 25, 32 and 36

IEC 61000-6-3, -6-4 , -6-8

CISPR 16 series

CISPR 25

Automotive equipment protection of on-board receivers

CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

- **Developed by CISPR sub-committee D**
  - **5th Edition was published on 16 December 2021**
  - **Will be published in Europe on national level only, e.g. BS EN 55025 (UK), DIN EN 55025 (Germany)**
  - **EN 55025 is not listed in the Official Journal of the EU and has no legal status**

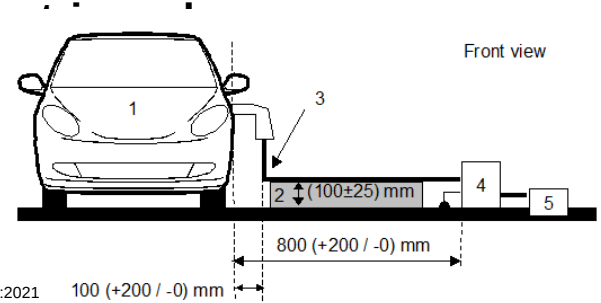
Therefore, the car component manufacturer has to apply the specific company standards of the car manufacturer, which are usually based on CISPR 25 or EN 55025 respectively

CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

- **What's New in Edition 5?**
  - **Maximum frequency extended up to 6 GHz for both component (ALSE method) and vehicle (voltage at internal antenna) testing, this will add new bands:**
    - 4G: 2496 to 2690 MHz, 3300 to 3800 MHz and 5150 to 5925 MHz
    - WiFi: 5150 to 5350 MHz and 5470 to 5725 MHz
    - C2X (Car-to-X Communication): 5850 to 5925 MHz
  - **Adds new GNSS band: BDS (BeiDou System)**
  - **Deletion of Annex F on TEM cell method**
  - **New Annexes J, K, L, M were be added on the consideration of measurement instrumentation uncertainty (MIU), also uncertainty budget is given (sample calculation)**

CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

- **What's New in Edition 5? (continued)**
  - **Revision of measurement methods in charging mode of electric and hybrid vehicles based on charging mode concept in IEC 61851-1 (Mode 1 to 4)**
    - **Mode 1: AC power charging on public power grid (no communication)**
    - **Mode 2: AC power charging on wall box (with communication)**
    - **Mode 3: AC power charging on charging station (with communication)**
    - **Mode 4: DC power charging on charging station (with communication)**
  - **Disturbance measurements in charging mode of el… hybrid vehicles if the charger is part of the vehicle**
    - Vehicle test – Voltage at internal antenna
    - The measurements are made without the engine running and all other equipment shall be switched off
    - AMN/AN-HV same as for CISPR 12



Source: CISPR 25:2021

CISPR News - All Emission Standards

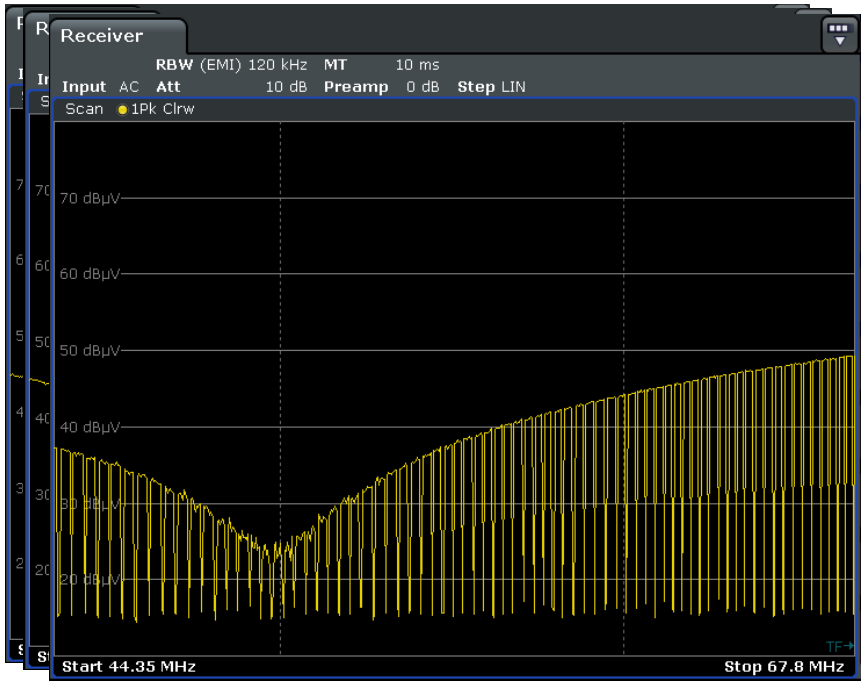
CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

- **What's New in Edition 5? (continued)**
  - **If using FFT-based instruments, the minimum measurement time should be 1 s**
  - **Using the minimum measurement time as defined in Table 2 with a measuring receiver can result in enormous measurement result**
  - **In a worst case the receiver will not capture the disturbance signal at all if the dwell time is shorter than the pulse repetition interval of the disturbance signal**
  - **Not suitable for measuring intermittent narrowband signals with CISPR-AV! Should be at least:**
    - **160 ms in AM Band (<30 MHz)**
    - **100 ms in Bands >30 MHz**
    - **≥1 s recommended in all Bands**

Service / Band	Frequency range MHz	Peak detection			Quasi-peak detection			Average detection		
		RBW at −6 dB	Max step size	Min measurement time	RBW at −6 dB	Max step size	Min measurement time	RBW at −6 dB	Max step size	Min measurement time
Analogue broadcast services										
LW	0,15 to 0,30	9 kHz	5 kHz	50 ms	9 kHz	5 kHz	1 s	9 kHz	5 kHz	50 ms
MW	0,53 to 1,8									
SW	5,9 to -6,2									
FM	76 to 108	120 kHz	50 kHz	5 ms	120 kHz	50 kHz	1 s	120 kHz	50 kHz	5 ms
TV Band I	41 to 88									
TV Band III	174 to 230									
TV Band IV	470 to 944									
Digital broadcast services										
DAB III	167 to 245	1 MHz	500 kHz	50 ms	Does not apply			1 MHz	500 kHz	50 ms
TV Band III	174 to 230									
DTTV	470 to 770									
DAB L Band	1 447 to 1 494									
SDARS	2 320 to 2 345									
Mobile services										
CB	26 to 28	9 kHz	5 kHz	50 ms	9 kHz	5 kHz	1 s	9 kHz	5 kHz	50 ms

CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

- **Wrong measurement time can result in enormous errors!**
  - **Pulse modulated carrier with 12 ms pulse period, Time Domain Scan shows closed trace with 12 ms measurement time**
  - **Gaps in TD Scan trace with 10 ms measurement time**
  - **Even when 10 ms yields a closed trace in Stepped Scan, zooming in reveals gaps in the trace**
  - **Important Measurement time ≥ signal period!**



CISPR 25 – AUTOMOTIVE EQUIPMENT MEASUREMENT OF HV COMPONENT AND MODULES

- Low Voltage:
  - DC Voltage below 60V , e.g. 12V/ 24V/ 48V batteries
  - The various electrically powered components in a conventional vehicle – including lights, wipers,
  - power windows and electronic control units – operate on a 12-volt direct current supplied by lead
  - acid battery
  - Low voltage batteries are used in both conventional (Internal combustion engine) and
  - electric/hybrid vehicles

- **Measurement of LV Componement:**
  - In CISPR25:2021(Edition 5) , Clause 6 states the measurement of emissions from components
  - and modules powered by LV power supply
  - LV power supply systems are typically un-shielded
  - Conducted emission on individual DC power lines (+ & -) : Voltage method
  - Conducted emission on EUT wiring harness as a bundle (including the DC power lines) :
  - Current probe method
  - Radiated emission : ALSE method and Strip line method

CISPR 25 – AUTOMOTIVE EQUIPMENT MEASUREMENT OF HV COMPONENT AND MODULES

- **High Voltage:**
  - DC Voltage between 60V to 1000V
  - High voltage DC battery (Traction battery) used to power the electric motors of electric or hybrid
  - vehicles , e.g. Lithium ion batteries
  - High Voltage batteries only used in electric/hybrid vehicles

- **Measurement of HV Component:**
  - DC Voltage between 60V to 1000V
  - High voltage DC battery (Traction battery) used to power the electric motors of electric or hybrid
  - vehicles , e.g. Lithium ion batteries
  - High Voltage batteries only used in electric/hybrid vehicles

CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

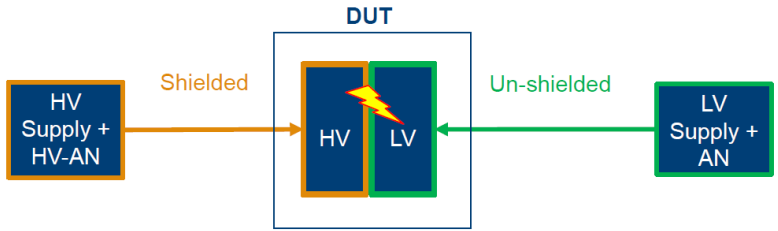
► MEASUREMENT OF HV COMPONENTS:

- In CISPR25 , Annex H states the measurement of HV components and modules
- HV power supply systems are typically shielded and LV power supply systems are un-shielded
- Components/modules used in electric vehicles are electronic components connected with LV power supply and/or HV power supply systems.
- Conducted emission : Current probe method (Limit lines are same as LV components)
- Radiated emission : ALSE method (Limit lines are same as LV components)
- Shielding can contain the high noise emissions within the HV cables and components , this is the
- reason to use LV limit lines for current probe and ALSE method
- Conducted emission : Voltage method (Special limit lines based on the shielding performance of the overall HV Systems)
- Shielding performance is determined by measuring the coupling attenuation between HV and LV networks of DUT . Less shielding performance or less attenuation between HV and LV networks means more stringent HV limit.

CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

► SOME BACKGROUND ABOUT HV-LV COUPLING

- In electric vehicles , more emission on HV components is allowed than LV components
- As HV Components and cables are shielded , vehicle will not be disturbed.
- Shielding prevents radiation of higher noise on HV side of DUT
- The weakness of shielding is the unshielded LV side of DUT , noise must be prevented to couple between HV and LV



CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

► MEASUREMENT OF CONDUCTED EMISSION-VOLTAGE

- To proceed for the measurement of conducted emission – Voltage , we need to perform the first step below :
  - Measurement of HV-LV Coupling attenuation of DUT
  - Create the special limit line according to the coupling attenuation by using the below formula :

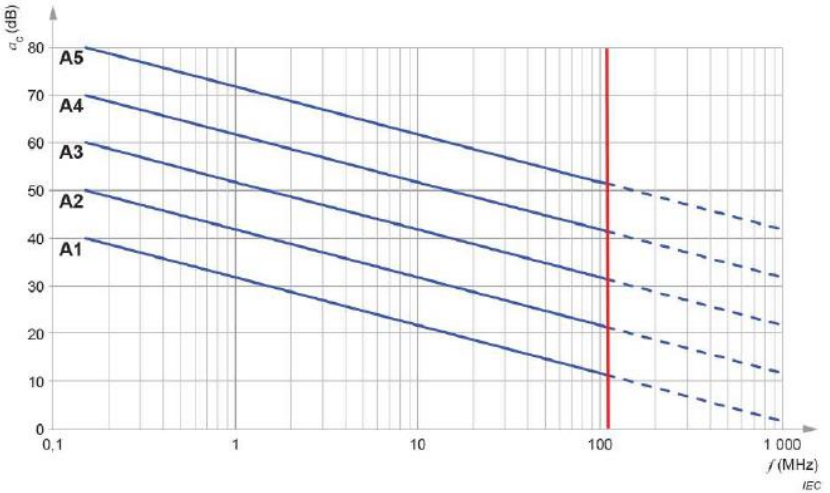
$$U_{\text{Limit,HV}} = U_{\text{Limit,LV}} + a_{\text{c,Ax}}$$

CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

- Attenuation Loss:

Table H.4 – Examples of requirements for minimum coupling attenuation, a_c

Frequency in MHz	Class	Minimum coupling attenuation, a_c in dB
0,15 to 1 000	A5	$80 - 10 \times \lg (f_{MHz}/0{,}15)$
	A4	$70 - 10 \times \lg (f_{MHz}/0{,}15)$
	A3	$60 - 10 \times \lg (f_{MHz}/0{,}15)$
	A2	$50 - 10 \times \lg (f_{MHz}/0{,}15)$
	A1	$40 - 10 \times \lg (f_{MHz}/0{,}15)$



The coupling attenuation above 108 MHz is informative

Figure H.18 – Examples of requirements for coupling attenuation, a_c

CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

► EXAMPLE OF HV LIMIT LINES FOR CE-VOLTAGE

Table H.1 – Example for HV limits for conducted voltage measurements at shielded power supply devices (HV-LV coupling attenuation class A1)

Service / Band	Frequency MHz	Levels in dB(µV)															RBW
		Class 5(A1)			Class 4(A1)			Class 3(A1)			Class 2(A1)			Class 1(A1)			
		Peak	Quasi-peak	Average	Peak	Quasi-peak	Average	Peak	Quasi-peak	Average	Peak	Quasi-peak	Average	Peak	Quasi-peak	Average	
Analogue broadcast services																	
LW	0,15 to 0,30	107	94	87	117	104	97	127	114	107	137	124	117	147	134	127	9 kHz
MW	0,53 to 1,8	84	71	64	92	79	72	100	87	80	108	95	88	116	103	96	
SW	5,9 to 6,2	77	64	57	83	70	63	89	76	69	95	82	75	101	88	81	
FM	76 to 108	50	37	30	56	43	36	62	49	42	68	55	48	74	61	54	120 kHz
TV Band I	41 to 88	47	-	37	53	-	43	59	-	49	65	-	55	71	-	61	
Mobile services																	
CB	26 to 28	61	48	41	67	54	47	73	60	53	79	66	59	85	72	65	9 kHz
VHF	30 to 54	59	46	39	65	52	45	71	58	51	77	64	57	83	70	63	120 kHz
VHF	68 to 87	51	38	31	57	44	37	63	50	43	69	56	49	75	62	55	

NOTE 1 All values listed in this table are valid for the bandwidths in Table 1 and Table 2. If measurements are performed with different bandwidths than those specified in Table 1 and Table 2 because of noise floor requirements, then applicable limits are defined in the test plan.

NOTE 2 Where multiple bands use the same limits the user selects the appropriate bands over which to test. When the test plan includes bands that overlap the test plan defines the applicable limit.

NOTE 3 Although the limits for peak, quasi-peak and average detectors are shown, measurements with all three detectors are not required. See Figure 1.

CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

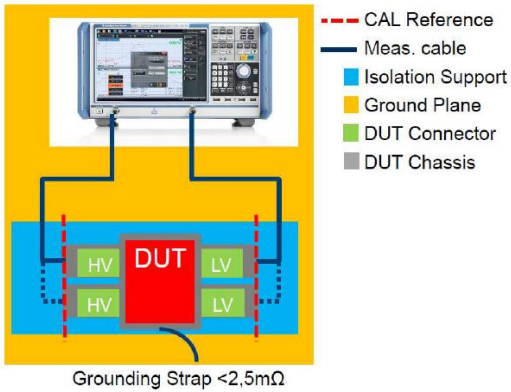
- Measurement Type of two methods:
  - Passive Method with DUT unpowered
  - Active Method with DUT powered

CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

► MEASUREMENT OF COUPLING ATTENUATION – PASSIVE METHOD

- According to CISPR25 , Vector network analyzer (VNA) must be used for the measurements
- Direct measurement of scattering parameters (S21)
- Measurements with Signal Generator, Power Meter, Spectrum Analyzer or EMI Receiver is not accepted.
- Good Adaption of HV or LV DUT Connector to RF Connectors must be assured.
- 50 Ohm measurement impedance does not reflect the real HV-System impedances
- Due to unpowered components, not all coupling paths are covered

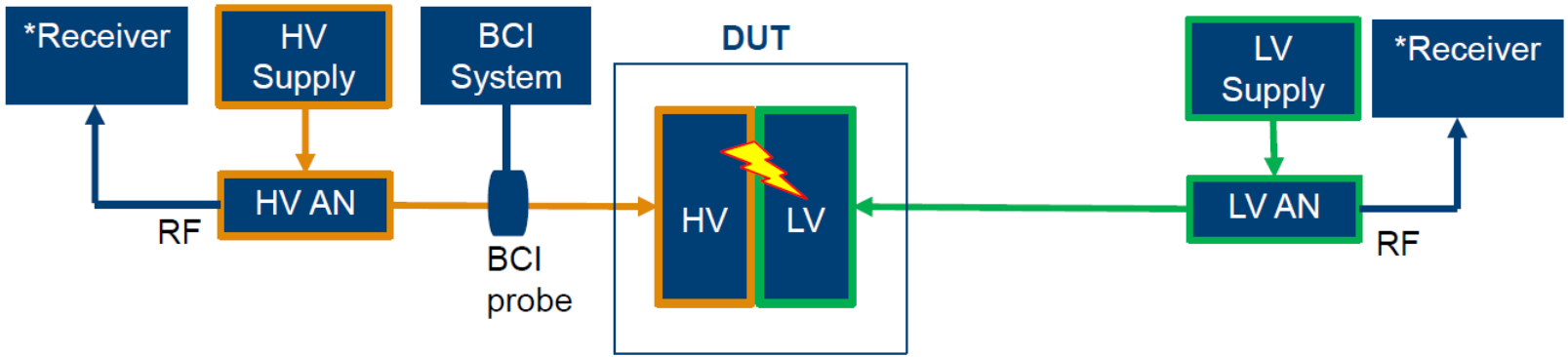
(Internal Switches and Semiconductors are open = High Attenuation)



CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

► MEASUREMENT OF COUPLING ATTENUATION – Active METHOD

- Two steps involved :
- 1. Reference Calibration
- 2. Measurement (Voltage , Current & Radiated emission)



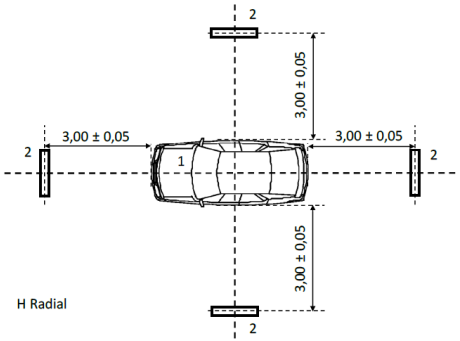
CISPR 36

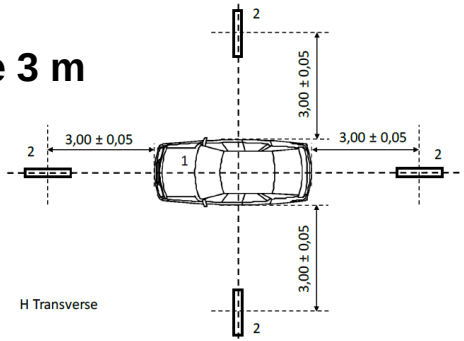
Automotive equipment protection of off-board receivers

Below 30 MHz

CISPR 36 – AUTOMOTIVE EQUIPMENT PROTECTION OF OFF-BOARD RECEIVERS

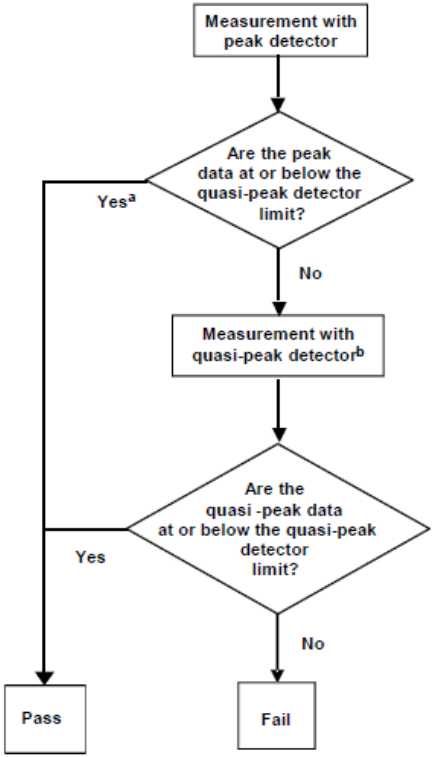
- **Developed by CISPR sub-committee D**
  - **1st Edition was published 22 July 2020**
  - **Electric and hybrid electric road vehicles**
  - **Quasi-peak limits for radiated emission (magnetic field) 150 kHz to 30 MHz, similar to CISPR 11 Class B Group 2 but more stringent above 4 MHz**
  - **Measurement with 60 cm Loop Antenna like R&S®HFH2-Z2E in Radial (X) and Transverse (Y) direction at four positions, centre of loop at fixed height of 1,30 m, measurement distance 3 m**
  - **Measurements with electric engine running only, constant speed 40 km/h ± 20 % driven on dynamometer without load**
  - **New normative Annex A on MIU, sample calculation in informative Annex B**





CISPR 36 – AUTOMOTIVE EQUIPMENT PROTECTION OF OFF-BOARD RECEIVERS

- **What's New in Amendment 1 to Edition 1?**
  - **Usage of term REES (rechargeable energy storage system) with voltages above 60 V, e.g. HV batteries**
  - **Adds peak detector for prescan**
    - **Receiver: Minimum measurement time = 50 ms**
    - **Spectrum analyzer: Minimum sweep time = 10 s/MHz**
    - **Can lead to a simplified and quicker conformance process if peak value is below Quasi-peak limit**
  - **Amendment 1 was published on 17 May 2023**



ISO11452-4

Road vehicles — Component
test methods for electrical disturbances
from narrowband radiated electromagnetic
energy —

Part 4:
Harness excitation methods

ISO11452-4 (2020) STANDARD: BULK CURRENT INJECT MEASUREMENT

- Frequency Range: :
- Test Level:

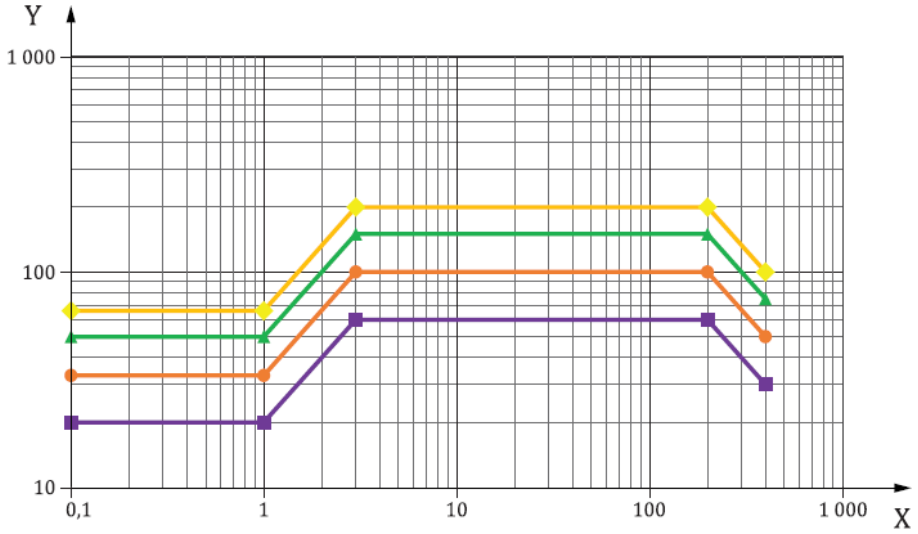


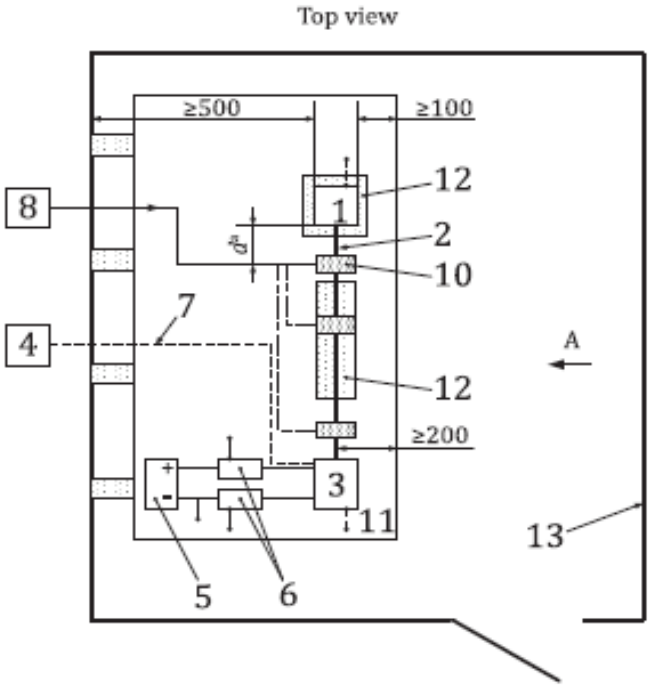
Table D.1 — Example of test severity levels (BCI)

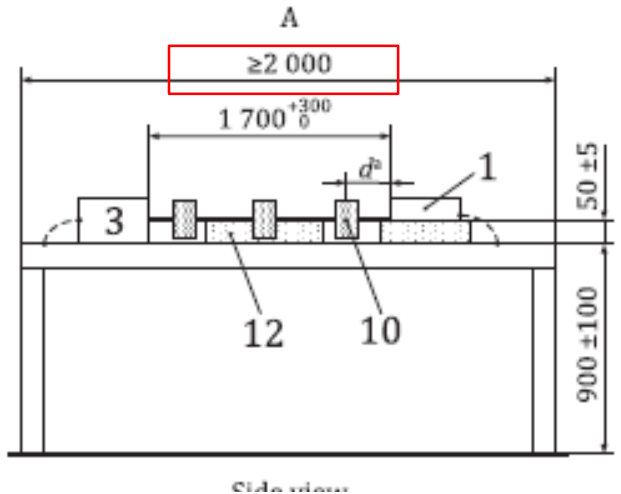
Frequency band (MHz)	Test level I (mA)	Test level II (mA)	Test level III (mA)	Test level IV (mA)	Test level V (mA)
0,1 to 1	20	33	50	66	Specific values agreed between the users of this document
1 to 3	$60 \times f^{a} / 3$	$100 \times f^{a} / 3$	$150 \times f^{a} / 3$	$200 \times f^{a} / 3$	
3 to 200	60	100	150	200	
200 to 400	$60 \times 200 / f^{a}$	$100 \times 200 / f^{a}$	$150 \times 200 / f^{a}$	$200 \times 200 / f^{a}$	

[a] In the formulae, f is in MHz.

ISO11452-4 (2020) STANDARD: BULK CURRENT INJECT MEASUREMENT

EUT TEST SETUP: SUBSITUITION METHOD





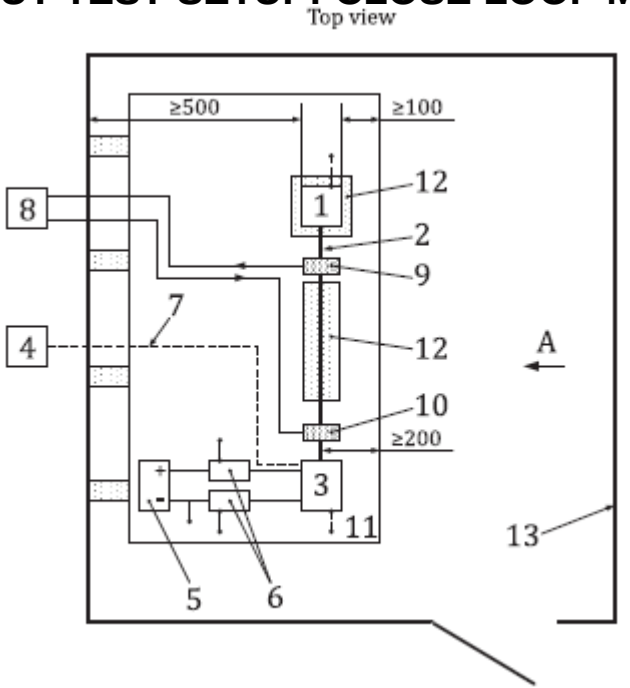
Side view

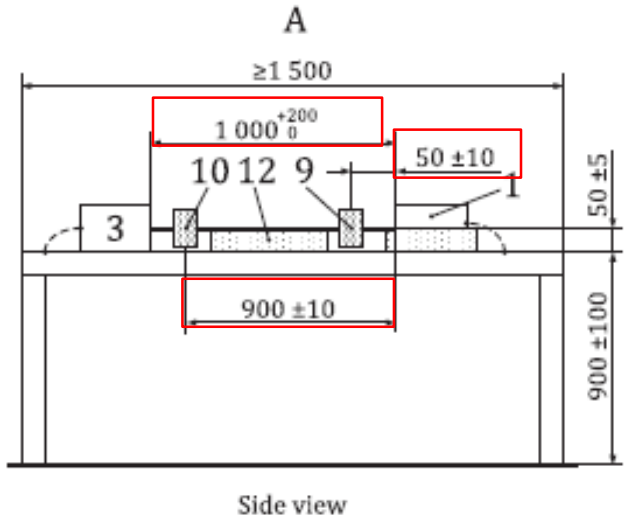
Key

1	DUT (grounded locally if required in test plan)	8	high frequency equipment (generator, amplifier and measuring instruments)
2	test harness	9	optional current measurement probe (not shown in this figure, but shown in Figure 2)
3	load simulator (placement and ground connection according to 7.5)	10	injection probe (represented at 3 positions)
4	stimulation and monitoring system	11	ground plane (bonded to shielded enclosure)
5	power supply	12	low relative permittivity support ($\varepsilon_r \leq 1{,}4$)
6	AN	13	shielded enclosure
7	optical fibres		
a	See 7.6.1.1.		

ISO11452-4 (2020) STANDARD: BI MEASUREMENT

EUT TEST SETUP: CLOSE LOOP METHOD

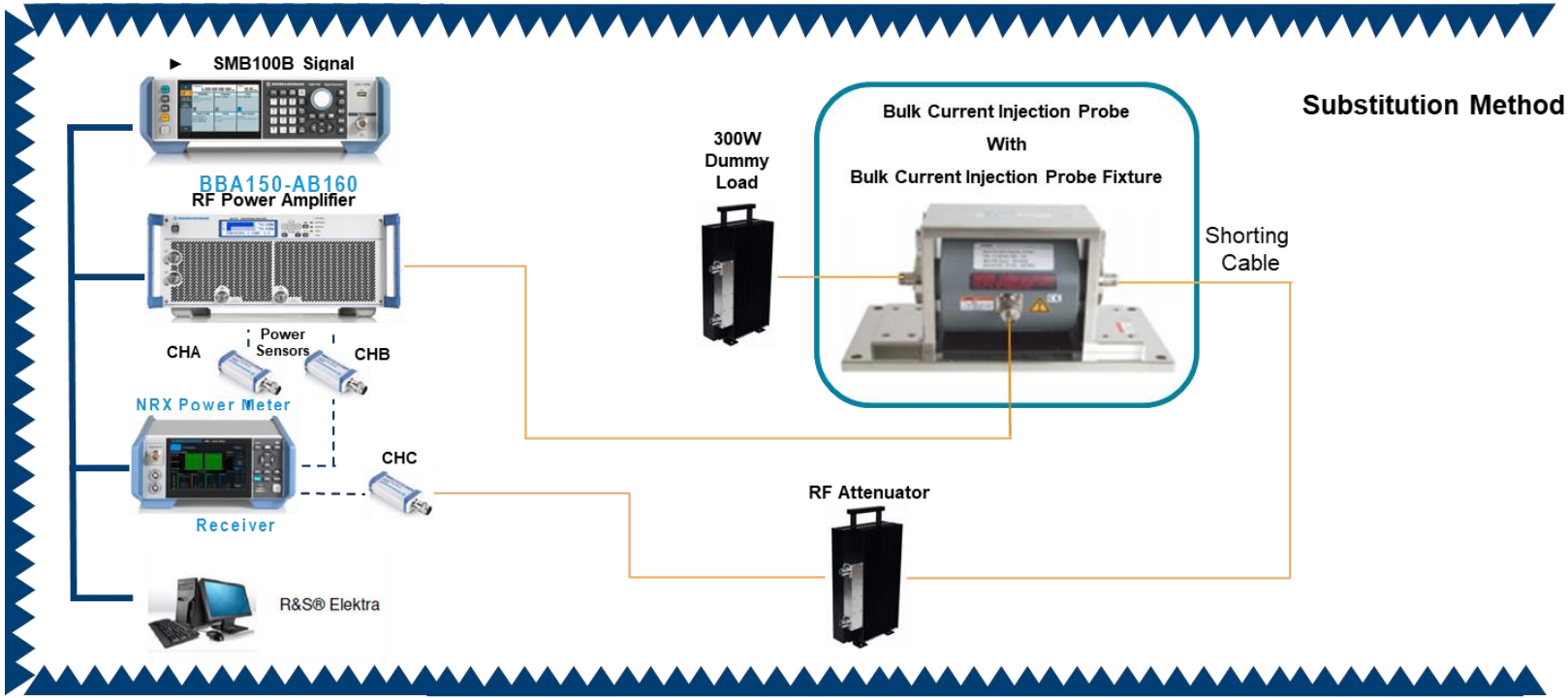




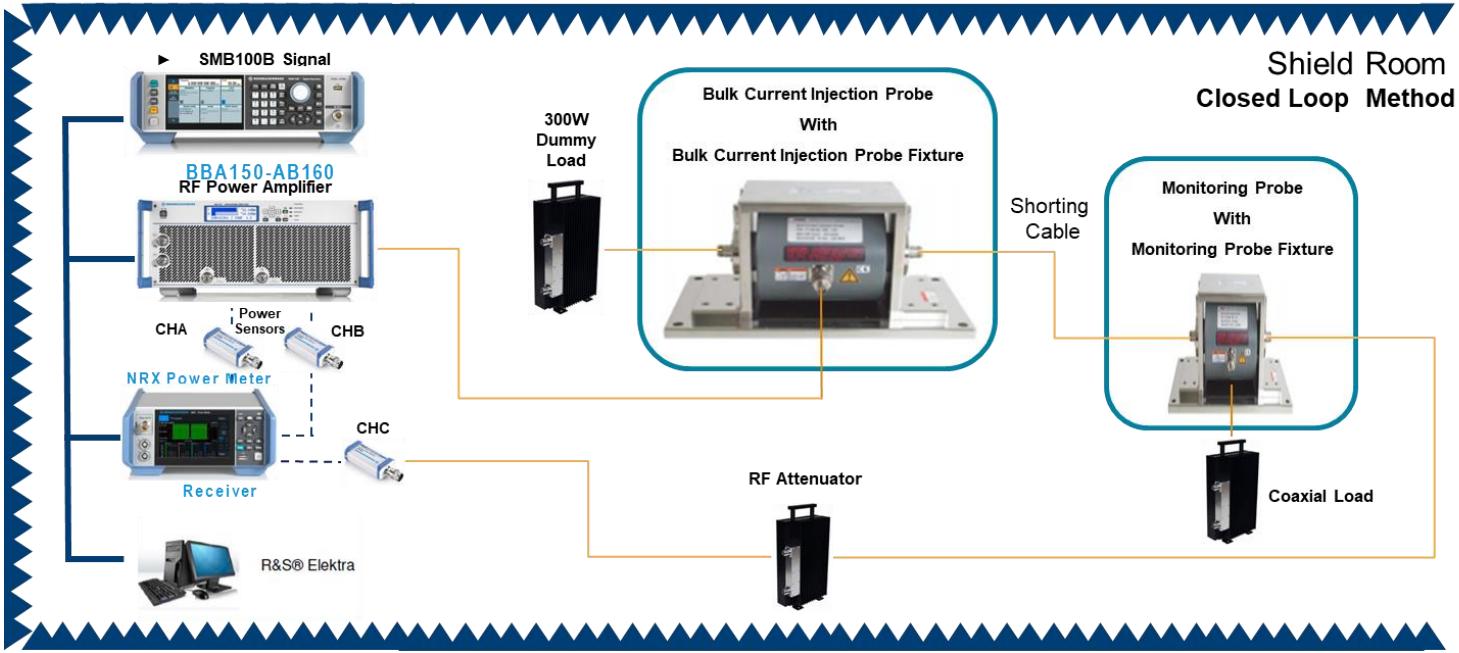
Key

1	DUT (grounded locally if required in test plan)	8	high frequency equipment (generator, amplifier and measuring instruments)
2	test harness	9	current measurement probe
3	load simulator (placement and ground connection according to 7.5)	10	injection probe
4	stimulation and monitoring system	11	ground plane (bonded-to shielded enclosure)
5	power supply	12	low relative permittivity support ($\varepsilon_r \leq 1{,}4$)
6	AN	13	shielded enclosure
7	optical fibres		

ISO11452-4 (2020) STANDARD: BULK CURRENT INJECT MEASUREMENT



ISO11452-4 (2020) STANDARD: BULK CURRENT INJECT MEASUREMENT



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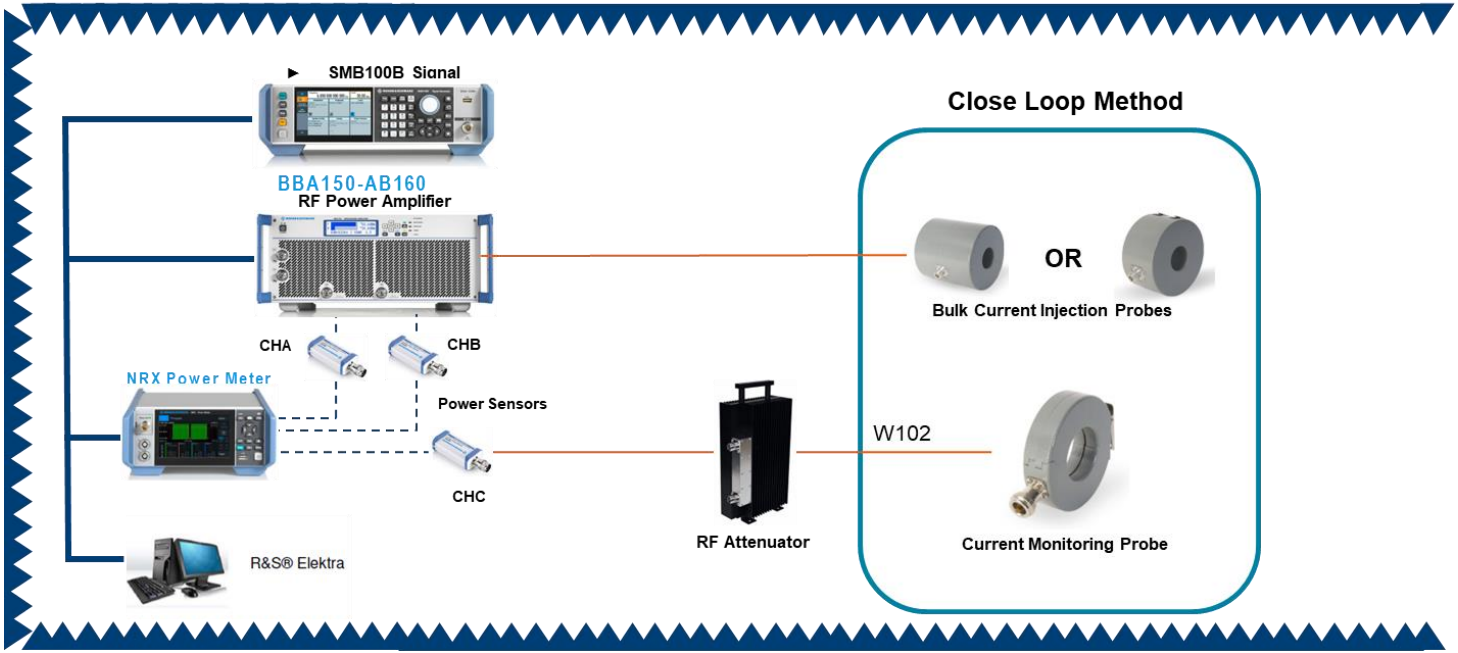
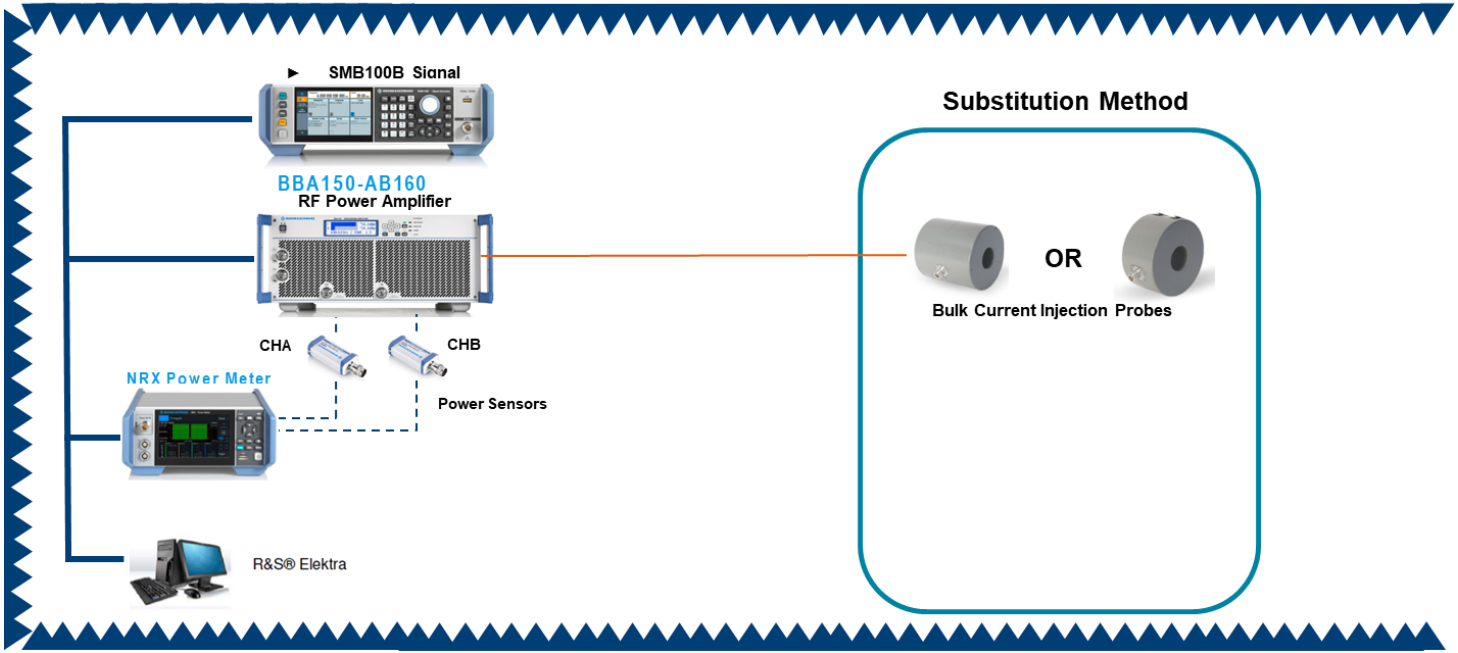
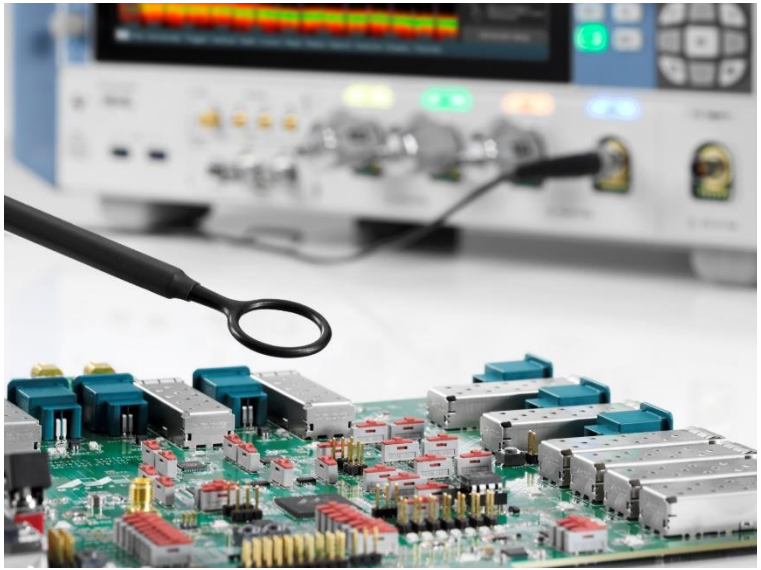


ISO11452-4 (2020) STANDARD: BULK CURRENT INJECT MEASUREMENT



EMC TEST SOLUTION OVERVIEW

FROM DEBUGGING TO SYSTEMS



COMPLIANCE RECEIVERS

- Receivers compliant to latest international EMI standard CISPR 16-1-1 **Edition 4**
  - Specified **6 dB bandwidths**, **detectors** (Quasi-Peak, CISPR-Average, RMS-Average)
  - High **dynamic range** required
    - Repetition frequency of pulses down to single pulse
  - Measurement Applications (**Click Rate, (Multi) APD, Bargraph**)
  - **Limit Line** checking and **Transducer correction**

R&S ESW

R&S ESR

R&S®ESW EMI TEST RECEIVER

High-end compliance receiver based on proven FSW platform

- 1 Hz to 8 / 26.5 / 44 GHz
- All relevant standards from commercial to military
- Best HF performance receiver and spectrum analyzer in one device

Highlights

- Sensitivity: Built-in preamplifier, optional LNA and notch filters
- Speed: Unique time-domain scan with parallel CISPR detectors
- Usability: Big high resolution touch screen
- MultiView: All needed measurements in one display

R&S®ESR EMI TEST RECEIVER

- **Measures up to 6000 times faster than conventional stepped frequency receivers**
- **Measurement of the levels of conducted disturbances in realtime**
- **Realtime analysis provide new, innovative capabilities in EMI diagnostics**
  - Realtime spectrum
  - Spectrogram mode
  - Persistence spectrum mode
  - Frequency mask trigger
- **Ease of operation due to**
  - Clearly structured touchscreen incl. Undo/Redo keys
  - Switching of operating modes at the press of a button
  - Configuration of automated tests directly on the touchscreen

SOPHISTICATED EMI RECEIVER

- Input Protection
- Preselection
- CISPR bandwidths and detectors
- MIL-STD-461 bandwidths
- 1 dB attenuation steps
- Preamplifier
- Autoranging
- Limit line library
- Report generation

PRODUCT INTRODUCTION
GENERAL DESCRIPTION BBA300-FAMILY

BBA300-CDE300

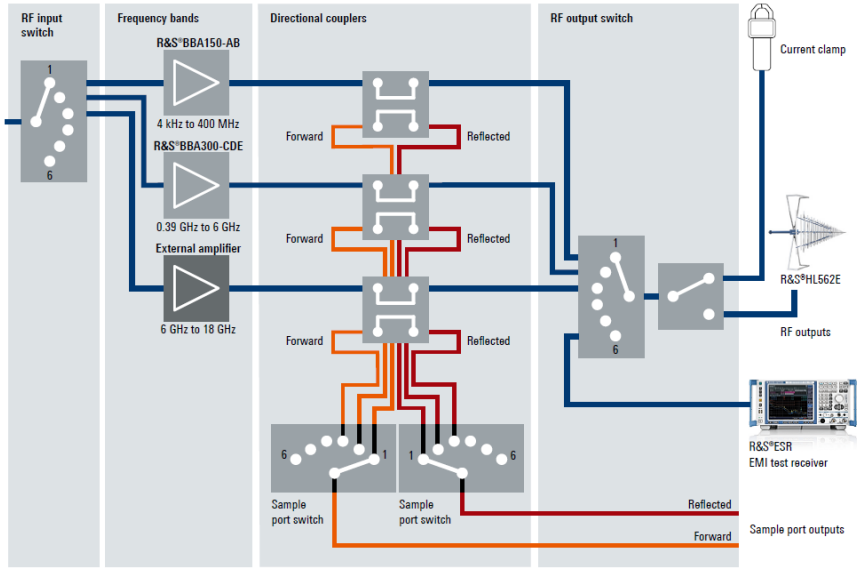
BBA300-CDE180

- New transistorized broadband amplifier family with:
  - Ultra wide bandwidths and frequencies
  - High power density and outstanding RF performance
  - Higher robustness and availability,
- New sophisticated RF concept for reliable and continuous operation
- New modular mechanical concept – optimized for better scalability and expandability in frequency and power.
- Flexible configurable as single-, twin-, dual- or multi-band amplifier system
- Available as 4HU desktop or 7HU – 46 HU rack solutions
- Coexist with BBA130/150 in one system

PRODUCT INTRODUCTION
GENERAL DESCRIPTION BBA300-FAMILY

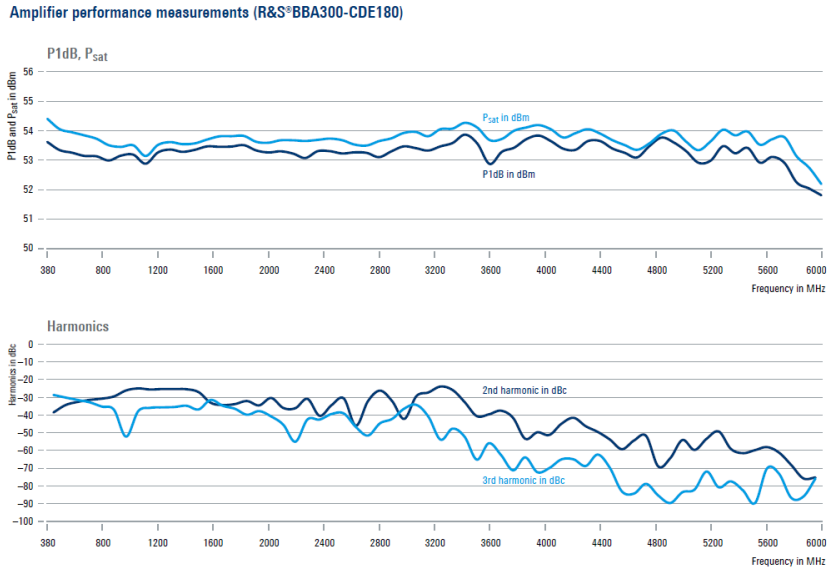
- BBA300 / BBA150 / third party amplifier in a mixed system with:
  - power detectors (option B140) and
  - multiple RF switches (option B116, B146, B126, B120)

Multiband amplifier system from 4 kHz to 18 GHz realized with switch options

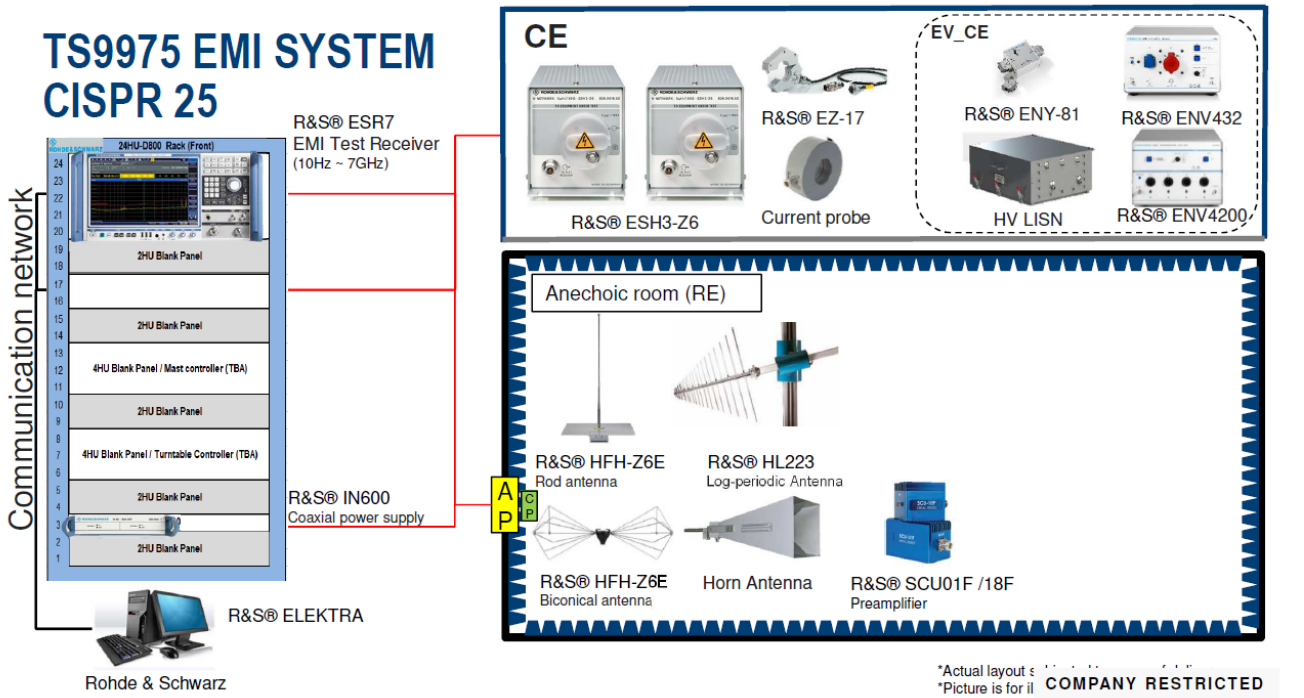


PRODUCT INTRODUCTION
GENERAL DESCRIPTION BBA300-FAMILY

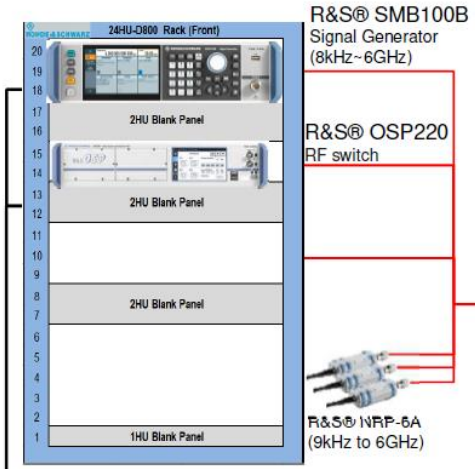
- BBA300-CDE amplifier series covers the frequencies between **380 MHz and 6 GHz**
- BBA300-DE amplifier series covers the frequencies between **1 GHz and 6 GHz**
- Both series are available in the following power classes:
  - BBA300-CDE15 / DE15: **15 W** P1dB (4HU desktop model)
  - BBA300-CDE30 / DE30: **25 W** P1dB (4HU desktop model)
  - BBA300-CDE50 / DE50: **50 W** P1dB (4HU desktop model)
  - BBA300-CDE90 / DE90: **90 W** P1dB (4HU desktop model)
  - BBA300-CDE180 / DE180: **180 W** P1dB (4HU desktop model)
  - BBA300-CDE300 / DE300: **300 W** P1dB (12HU rack model)



EMC TEST SOLUTION OVERVIEW
-TS9975 EMI TEST SYSTEM_CISPR25



EMC TEST SOLUTION OVERVIEW -TS9982 EMS TEST SYSTEM



R&S® SMB100B
Signal Generator
(8kHz~6GHz)

R&S® OSP220
RF switch

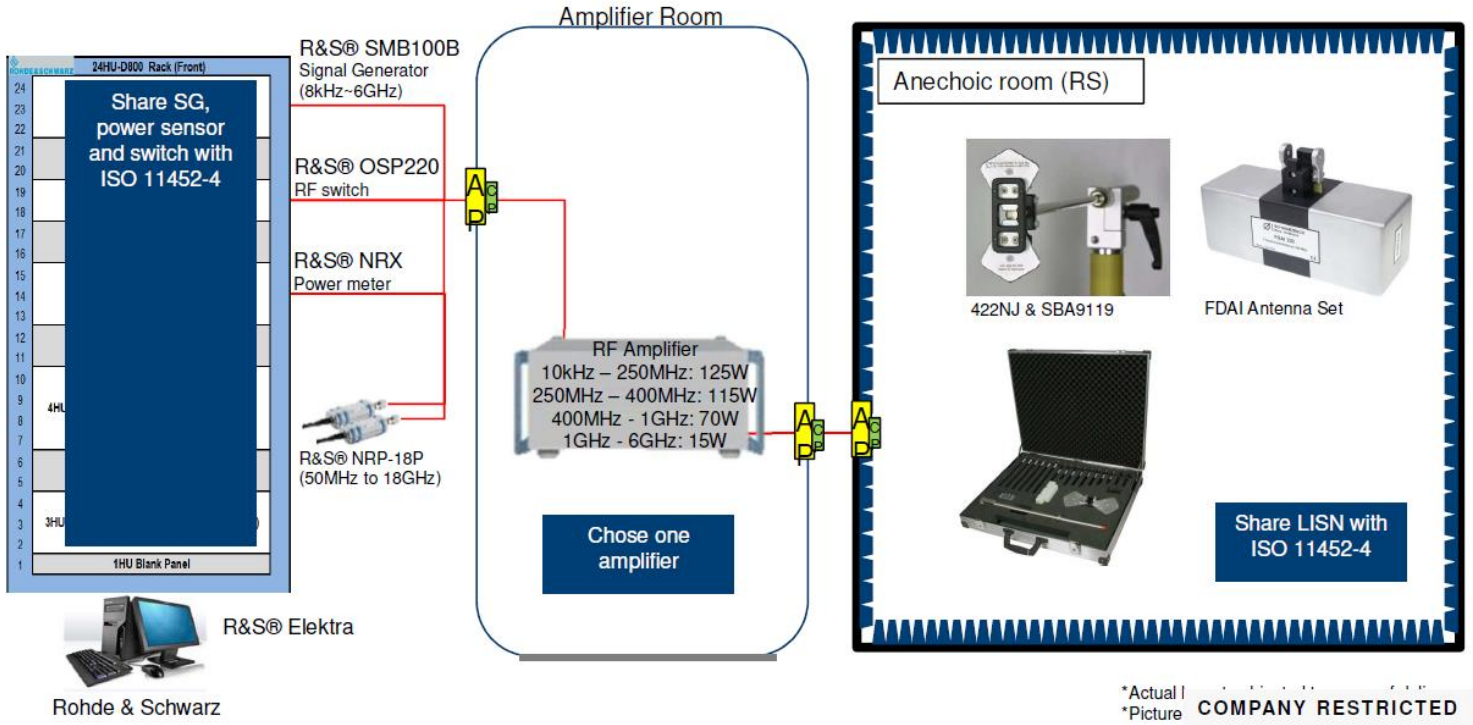
R&S® NRP-6A
(9kHz to 6GHz)

R&S® Elektra

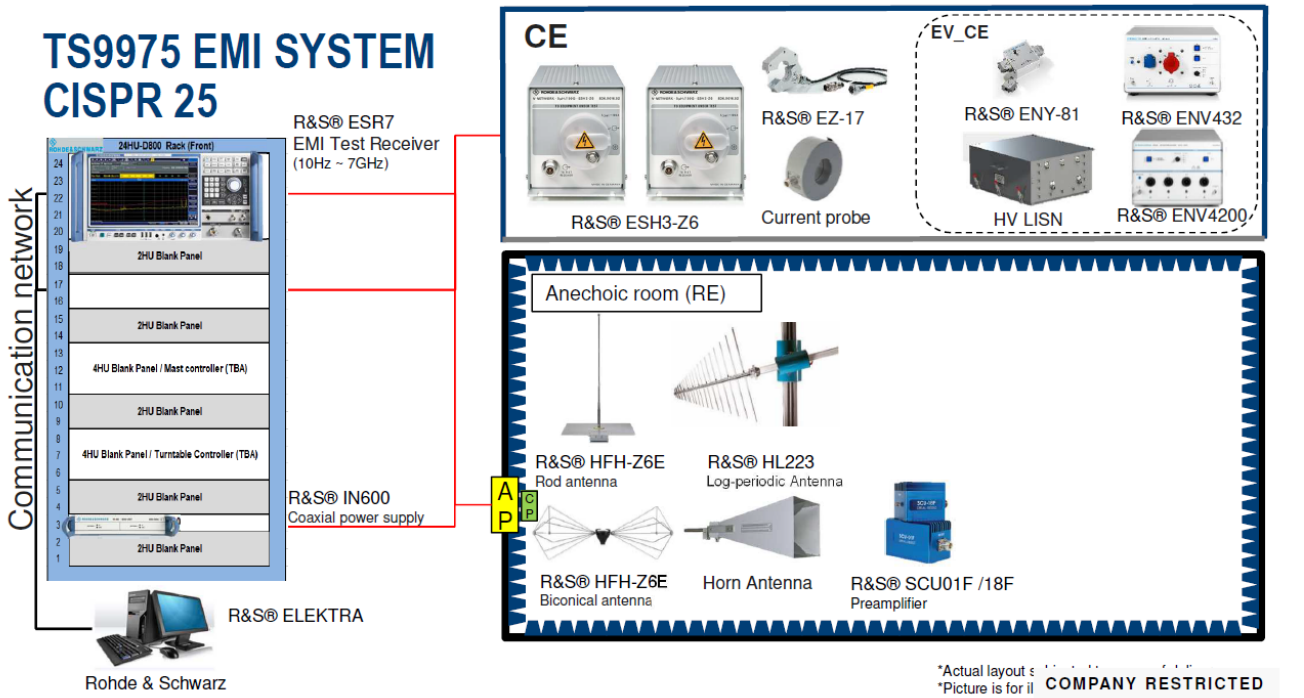
Rohde & Schwarz

*Actual
*Picture is for illustration only

EMC TEST SOLUTION OVERVIEW -TS9982 EMS TEST SYSTEM



EMC TEST SOLUTION OVERVIEW -TS9975 EMI SYSTEM_CISPR25



R&S®ELEKTRA

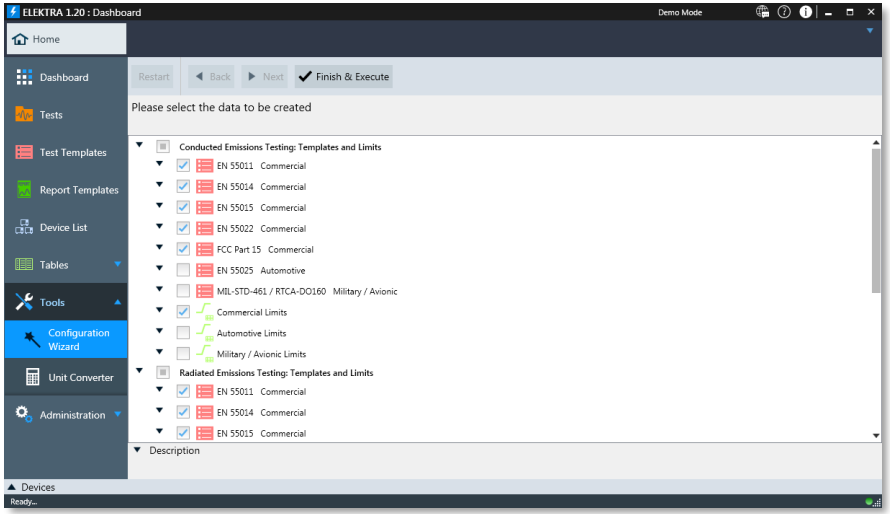
KEY FEATURES FOR EMI, EMS AND RSE

Plan	Execute	Analyse	Report
• Migrate your data from other EMC SW • Sync data with other data bases • Manage EUTs • Use test template library • Create test plans • Configure tests • Easily exchange instruments • Simulate before run	• Control R&S and 3rd party instruments • Control EUT stimulation devices • Calibrate field and cables • Automate tests with sequences • Switch between Interactive/automated mode • Work in parallel windows • Monitor the EUT	• Critical points analysis automatically or manually • Apply post measurement analysis • Create grpahs including 3D • Compare results	• Customize report • Automatically create acc. To automotive standards • Add multiple tests to report • post process in ext. word processor and add results from other systems • Sync results with other data bases

R&S®ELEKTRA

PREDEFINED LIBRARY OF TEST TEMPLATES

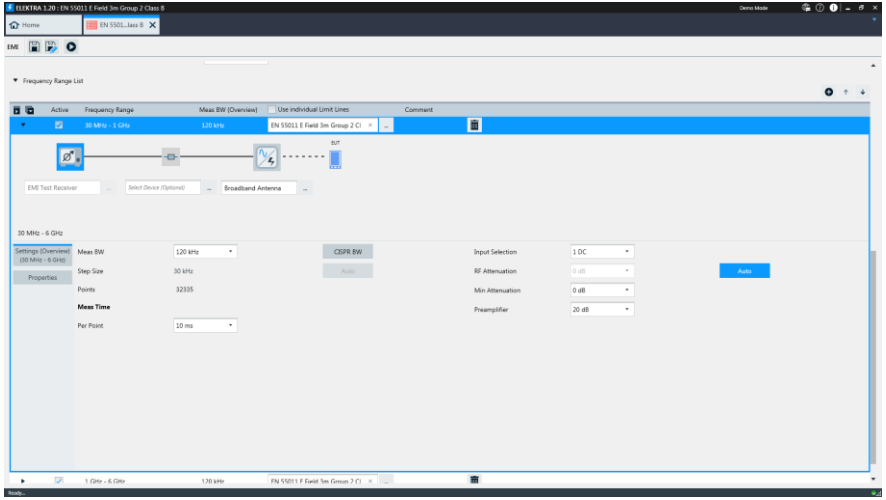
- Predefined templates, transducer factors, and limit lines
- Templates are editable, no need to start from scratch! Simply exchange used equipment and cal. data
- Automatically detect connected instruments



R&S®ELEKTRA

EASY ACCESS TO SETTINGS

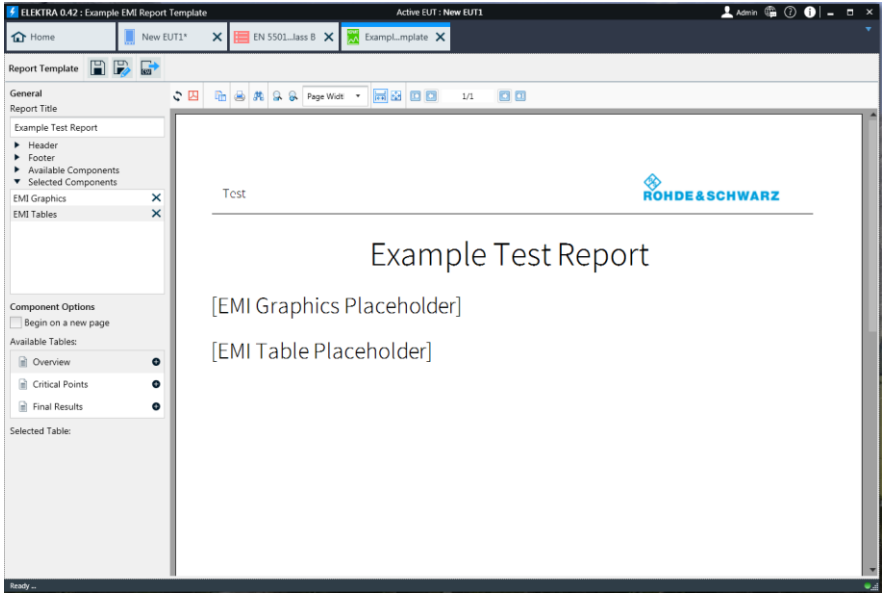
- Most of the settings are available from multiple tabs
- No need to switch back and forth form device list to template and hardware setup.
- Forgot to define a limit line? Just create it from the test template tab, without window-hopping



R&S®ELEKTRA

DASHBOARD, SEARCH AND TAGGING

- Pin frequently used items to dashboard for convenient access
- Or use the powerful search function
  - Phrases
  - Frequency ranges
- Open multiple tabs to compare test templates, tests, prepare reports…even while waiting for a test to finish.



R&S®ELEKTRA
EUT MANAGEMENT

- Define a list of tests to be executed for multiple EUTs
- See status of test results
- Easily create reports with results from multiple tests, post process in MS Word.